LEO J.
HICKEY

"Rite in the Rain"®

WEATHERPROOF

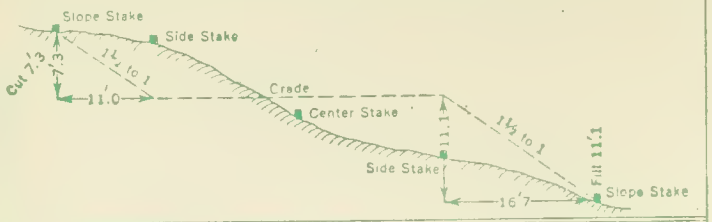
Mining Transit Book

No. 320

DISTANCES FROM SIDE STAKES FOR CROSS-SECTIONING

Roadway of any Width. Side Slopes 1½ to 1.

In the figure below opposite 7 under "Cut or Fill" and under .3 read 11 0, the distance out from the side stake at left. Also, opposite 11 under "Cut or Fill" and under 1 read 16.7 the distance out from the side stake at right



Cut or Fill	0	.1	.2	.3	.4	.5	.6	.7	.8	.9	Cut or Fill
	Distance out from Side or Shoulder Stake										
0	0.0	0.2	0.3	0.5	0.6	0.8	0.9	1 1	1 2	1 4	0
1	1.5	1.7	1.8	2.0	2.1	2.3	2.4	2.6	2.7	2 9	1
2	3.0	3.2	3.3	3.5	3.6	3.8	3.9	4.1	4 2	4.4	2
3	4.5	4.7	4.8	5.0	5.1	5.3	5.4	5.6	5.7	5 9	3
4	6.0	6.2	6.3	6.5	6.6	6.8	6.9	7.1	7.2	7.4	4
5	7.5	7.7	7.8	8.0	8.1	8.3	8 4	8.6	8.7	8.9	5
6	9.0	9.2	9.3	9.5	9.6	9.8	9.9	10.1	10 2	10.4	6
7	10.5	10.7	10.8	11.0	11.1	11 3	11.4	11.6	11.7	11 9	7
8	12.0	12 2	12.3	12.5	12.6	12.8	12.9	13.1	13.2	13.4	8
9	13.5	13.7	13.8	14.0	14.1	14.3	14.4	14.6	14.7	14 9	9
10	15.0	15.2	15.3	15.5	15.6	15.8	15.9	16.1	16.2	16 4	10
11	16.5	16.7	16.8	17.0	17.1	17.3	17.4	17 6	17 7	17.9	11
12	18.0	18.2	18.3	18.5	18.6	18.8	18.9	19.1	19 2	19 4	12
13	19.5	19.7	19.8	20.0	20.1	20.3	20.4	20.6	20.7	20.9	13
14	21.0	21.2	21.3	21.5	21.6	21.8	21.9	22.1	22.2	22.4	14
15	22.5	22.7	22.8	23.0	23.1	23.3	23.4	23.6	23.7	23.9	15
16	24.0	24.2	24.3	24.5	24.6	24.8	24.9	25.1	25.2	25 4	16
17	25.5	25.7	25.8	26.0	26.1	26.3	26.4	26 6	26.7	26.9	17
18	27.0	27.2	27.3	27.5	27.6	27.8	27.9	28.1	28.2	28.4	18
19	28.5	28.7	28.8	29.0	29.1	29.3	29.4	29.6	29.7	29.9	19
20	30.0	30.2	30.3	30.5	30.6	30.8	30.9	31.1	31.2	31.4	20
21	31.5	31.7	31.8	32.0	32.1	32.3	32.4	32.6	32.7	32.9	21
22	33.0	33.2	33.3	33.5	33.6	38.8	33.9	34.1	34.2	34.4	22
23	34.5	34.7	34.8	35.0	35.1	35.3	35.4	35.6	35.7	35.9	23
24	36.0	36.2	36.3	36.5	36.6	36.8	36.9	37.1	37.2	37.4	24
25	37.5	37.7	37.8	38.0	38.1	38.3	38.4	38.6	38.7	38 9	25
26	39.0	39.2	39.3	39.5	39.6	39.8	39.9	40.1	40.2	40.4	26
27	40.5	40.7	40.8	41.0	41.1	41.3	41.4	41.6	41.7	41.9	27
28	42.0	42.2	42.3	42.5	42.6	42.8	42.9	43.1	43.2	43.4	28
29	43.5	43.7	43.8	44.0	44.1	44.3	44.4	44.6	44.7	44.9	29
30	45.0	45.2	45.3	45.5	45.6	45.8	45.9	46.1	46.2	46.4	30
31	46.5	46.7	46.8	47.0	47.1	47.3	47.4	47.6	47.7	47.9	31
32	48.0	48.2	48.3	48.5	48.6	48.8	48.9	49.1	49.2	49.4	32
33	49.5	49.7	49.8	50.0	50.1	50.3	50.4	50.6	50.7	50.9	33
34	51.0	51.2	51.3	51.5	51.6	51.8	51 9	52.1	52.2	52 4	34
35	52.5	52.7	52.8	53.0	53.1	53.3	53.4	53.6	53.7	53.9	35
36	54.0	54.2	54.3	54.5	54.6	54.8	54.9	55.1	55.2	55.4	36
37	55.5	55.7	55.8	56.0	56.1	56.3	56.4	56.6	56.7	56.9	37
38	57.0	57.2	57.3	57.5	57.6	57.8	57.9	58.1	58.2	58.4	38
39	58.5	58.7	58.8	59.0	59.1	59.3	59.4	59.6	59.7	59.9	39
40	60.0	60.2	60.3	60.5	60.6	60.8	60.9	61.1	61.2	61.4	40

Leo J. Hickey

"Rite in the Rain"®
WEATHERPROOF

a product of

J. L. DARLING CORPORATION
TACOMA, WASHINGTON 98421 U.S.A.

Sec. 8 S 39

Remeasured 7/24/85

Unit no	Thickness	Description
		Top of the Kanyuk Fm Black Shale w/ sulfur smell, fissile with thin lt. yellowish gray siltstone. Clay ironstone ledges up to 8" thick (rare). Becoming silty in upper 30 meters finely laminated silt and shale. Silt increases upward. Color changing from dark gray to yellow gray true dip 50° E
Apparent dip 15°		
		Contact w/ E.S. gradational but marked where silt > clay

unit no	thick	des
1	1.5 m	yellow gray parallel
	1.5 m	lam siltstone with
	1.5 m	med gray siltstone
		interbeds
		Eureka Sound Formation
		base
		med gray mudstone abrem
	1.5	slumpy area
	1.5	
	1.5	
	1.5	
	1.5	
	1.5	

Apparent dip flattens to 10°

1.5
1.5
1.5
1.5
1.4

Σ = 20.9m

Apparent Dip change to 5°

Unit no	thick	des
2	2.0 m	yellow (grayish) parallel lam fuzzy vfg silty sand stone distinctive unit forms a shoulder clay iron stone at top 6"
3	1.m	Clay partings fissile med gray shale some limonite staining

True dip 52° E

4	2.0m	vf silty sandstone yellow gray tabular cross-laminated w/ org rich layers and clay rip up clasts generally flat bedded some fe-layers forms shoulder org more abundant at 4/
	2.0	
	2.0	
	2.0	
	2.0	
	2.0	

$\boxed{\Sigma = 12m}$

Unit no	thick	descrip
4 cont		coarsens upwards from vfg to fg to med to slightly coarse
5	0.3m	sandy finely laminated, punky w/ roots and many organic partings underclay (soil)
6	0.8 m	Coal undulating top
7	0.55m	punky sandstone carb. laminae clay fe-stn at top gypsum top underclay underclay

Unit no	~~Des~~ thick	descrip
8	0.9 m	interbedded dk gray shale + lt gray siltstone grades into next unit
	8539 a pollen sample at base	shale > silt (2 cm interbeds
9	2.1	siltstone lt gray w/ thin dk gray shale (similar as in 8 grades up to 10 silt > shale
10	2.5 m	shale parallel dark gray at base becoming yellow up.
	8539 b pollen sample	

11	.9m	interbedded shale siltstone and fg SS in parallel units which are rippled
12	2.2m	med grained, lt yellow gray SA SS with shale laminae towards base, a lag of Fe stone conc Fe-stone layers up to 5cm thick clay rip-up clasts tabular x-bedded grades into Unit 11

true dip 62°E

13	2.0	interbedded sequence of
	2.0	siltstone, punky
	2.0	mudstone dk gray to
	.2	med brown, parallel
	$\boxed{\Sigma = 6.2m}$	bounded units

14	18 m	yellow vf to f SS org-rich in basal 30 cm some ripples

Apparent dip 44°

15	2.0	interbedded SS (yellow brown) fi to m gr. w/ ripple + trough x-bed and laminae of very dark shale. Some Fe stain layers lag + rip up clasts at base SS bed thickness ~ 10 cm very rhythmic unit
	2.0	
	2.0	
	2.0	
	2.0	
	2.0	
	1.0	
	$\Sigma = 13$ m	
16	2.0	med brownish gray siltstone with mudstone in parallel units, punky in appearance. Some Fe-stained layers
	2.0	
	$\Sigma = 4.0$ m	

True dip 60° E

17	0.25 m	coal
18	1.6 m	lt. yellow indurated siltstone, some surficial ~~fer~~ staining
19	1.2 m	dk gray mdstone
20	2.0	very lt yellowish gray med SS
	2.0	
	2.0	
	2.0	angular grit grains
	2.0	and cgl lenses
	2.0	at the base
	2.0	
	2.0	forms massive
	2.0	white cliff
	2.0	
	2.0	some tabular x-beds
	2.0	thin shale splits
	2.0	
	$\boxed{\Sigma = 26\ m}$	

21	2.4 m	Coal somewhat clayey at base (lower) cliff former

Apparent dip 40° E

22	2.0	measured up gully through unit that is very similar to unit 20 but slightly darker gray and not quite as prominent a bluff former ss.
	2.0	
	2.0	
	2.0	
	2.0	
	2.4	
	$\boxed{\Sigma = 12.4 m}$	
23	2.0 m	Coal which is shaley at its base and its top
	1.5 m	
	$\boxed{\Sigma = 3.5 m}$	shale carbonaceous top of offset

OFFSET

23		Coal ± 2
	True dip 37° E	
24	2.0	fissile dk gray
	2.0	carb. mudstone
	1.6	~~laminated in broad~~
	$\boxed{\Sigma = 5.6\,m}$	
25	1.5	rusty gray fi to med SS grading up to siltstone and to unit above Carb in layers and punky at top
26	.4 m	lignite
27	1.8 m	dk gray carb. fissile mudstone becoming yellowish-gray upward
28	3 m	interbedded vfg SS and siltstone with mudstone lt yellowish gray to med. brownish gray appear finely parallel lam in weathered section

Dazzlmeo
1st Officer
Seg 1359
Hidden in Kuwait coast
Coal #1
Coal #2
Wood Unit 20
Stream
Thick of Kuwait

29	1.3 m	lignite base is a 10 cm underclay soil developed on unit below
30	1 m	SS med to coarse tabular lt yellowish gray limonite staining lower 10 cm is a grit w/ poor sorting
31	19.3 m	Interbedded fine sand shales and mudstones rippled w/ some ironstone becoming sandier to the top
	2 m	
	2 m	
	2 m	Underclay for top 30 cm
	2 m	
32	1.05 m	lignite thickens to North

33	2m 2m 2m 2m .4m $\boxed{\Sigma = 8.4m}$	Massive lt yellow gray f to m sand becoming parallel to top. with massive fe-stone nodules on top
34	1m	~~clay~~ friable red gray mudstone w interbed of lt yellow sandy silt
35	2m 2m .5m $\boxed{\Sigma = 4.5m}$	lignite fe-stone in the coal 20cm thick
True dip 57° E		
36	2m 2m 2m .5m $\boxed{\Sigma = 6.5m}$	lt yellow gray fg diff Sa friable ss w irreg parallel laminae of red yell gray mudstone irreg lamination appears in cliff face

37	2m 2m 2m $\boxed{\Sigma = 6m}$	inter beds of carbonaceous mudstone with lignite stringers and siltstone w/ carb shale stringers and sandstone in beds ranging from .25 to .75 m thick med brown weathering tan
38	.4	lignite w/ 6 inch underclay
39	2m 2.9 m $\boxed{\Sigma = 4.9m}$	same as 37
40	4.3 m	grayish brown shale friable w/ .2 m lignite at base laterally equivalent to unit 41

rubble colluvium at base

OFFSET

41	2m est	yellowish gray sand w/ Fe-stone concs laterally equivalent to unit 40
42	2 m	Interbedded sequence of shale, mudstone and lignite
	2 m	
	2 m	
	2	lignite up to -25 m
	2	sort of a stump
	2.4m	iron unit
	12.4m	
43		lignite

OFFSET

43	1 m	lignite

44	1.3	gray massive mudstone
45	.4 m	lignite
46	1.8	interbedded gray mudstones and lignite Pollen Sample 8535 from upper gray shale in upper half meter
47	.6	lignite
48	.5 m	red gray mudstone
49	.2 m	lignite
50	2 2 2 1.8	red gravel silty SS w/ carb trash and wood on bedding plane mainly massive but
$\Sigma = 7.8$ m	clay galls	suggestion of tab bedding

51	2	SS as in unit 50
	1	interbedded with dk gray
		siltstone

total thickness to here is 234.65 cm

Fit this section into level paced section at end of 8535

July 25, 1985

moved from Remus Creek to Strand Fiord by way of Eureka. With w/ Jim, pilot. Just about stalled plane on takeoff from Remus Cr, because he pulled the nose too far up. Rough landing at Remus on tundra. Strand mostly fogged in landed at GSC camp just east of Kangok River on a delta terrace. Could not get helicopter in ~~been~~ to complete move because of fog which finally lifted (partially) at around 4 pm

Don Hodgson "Last Glac of Ellesmere Is., CJES 22: 347-368

July 26, 1985

Unable to move once again because of fog for most of day lifted again around 4 o'clock

Read & chatted in tent all day w/ a ramble after dinner at 8:30 to 10:00 pm.

walked N. up valley of Kangok River over 4 distinct terrace levels with notified beach ridges clearly evident on the lowest 3 of them

Observed type section of the Kangok fm which is rusty black weathering shale w/ no sign of the ~~lens~~ white ss lenses seen in its upper part on Fushiem Peninsula

July 27, 1985

Once again, thick clouds over the Princess Margaret Arch to the east prevented the helicopter from reaching our position. Walked 3 mi east ~~to~~ along N. shore of fiord to a point near its head where we could see the Strand Fiord Glacier descending from Strand Fiord pass.

Partly sunny through day. Observed the fantastic shapes of the ice bergs stranded in the fiord and took many pictures.

Windy & rainy in night.

July 28, 1985

Same story, no move although Earl in Helicopter PFK made a valiant effort to find a hole in the clouds shrouding the mts.

In early afternoon after Earl told us he couldn't make it we observed a lone musk ox on the terraces N. of camp and shortly afterward two others, a large bull and a cow just across the Kangnuk River to our northwest. We set out with camera & binoculars to observe the beasts, with Kirk in hot pursuit of the lone one and Cliff, Mack, and I toward the two. They felt safe on the far side of the river so they were easy to photograph as they took forever to decide that they didn't want to face us curious creatures on the other side of the stream.

Fairly clear over the arch this evening. Tomorrow we go by air or by foot!

July 29
EAST Creek ON STRAND
FIORD MEASURED Sec 7.
Sec 85 40

UNIT NO	Thick.	Descr.
		As mapped by GSC, a sandstone ledge in the Kanguk is marked as base of E.S. Unit i 90-95% black Kanguk shale with thick orthoquartzite sandstone.
	dip 90°	measured by tape
1	50 ft	vertically dipping interbedded
	50 ft	dk gray shales and tabular
	25 ft	yellowish to reddish brown
		med gr. ss. with ripples
	(125)	and tab x-beds
		ss up to 10 m thick
		with black shale up to 10 m
		underlain by black shale
2.	100 ft	black shale of Kanguk
	50 ft	nature
	30 ft	
	(180)	

UNIT NO	Thick	Des
3	50 ft	med gr. rounded well sorted ortho quartzite no fldspar
	(50)	shale split in middle undulate upper + lower
4.	150 ft	black shale with occasional coaly (at base) and
	100 ft	
	54 ft	15-20 cm sandy split
		some brown streaks
	(304)	pollen sample 8540 a at base
5	40 ft	SS yellow brown med grain orthoquartzite
	50 ft.	greenish stain on bedding surface (iron manganese)
	4.5 meters.	each. subrounded to rounded
		beds 5-15 ft thick
	(103)	3 major beds
		each about 8-10 m thick
		5-5-8
		with interbedded dark gray shale except the upper split is a 4½ meter coal.

Unit no	thick	des
6	300 ft	black shale
	200 ft	~~5 to cm beds~~
		occasional lighter
	500	streaks.
		laminated dk gray
		shale with 1-3 cm
		brownish gray laminated
		mudstone
		looks marine
		pollen sample 85406
		at 300 ft.
		shale >> mudstone
7	100 ft	laminated mudstone unit
	13 ft	in 2-4 cm beds
		shale beds 1-2 cm
		shale << mudstone
	113	
		becoming shaley in
		upper 50 ft
		with one 2 meter thick

Unit no	thick	des
8	25 ft	flaggy vfg yellowish brown weathering SS parallel bedded w/ carb laminae and rare thin (1cm) coals and occasional mudstone
	50 ft	
	50 ft	
	45 ft	
	(170)	
		~~pollen~~ ~~samp~~ sticks and plant debris on many bedding planes
		flagstone at 75 ft
		top 20 ft are rippled
9	50 ft	dk gray chippy shale no silt
	(50)	Pollen sample 8540c

unit no	thick	description
10	50 ft.	ss, flaggy becoming massive (1 meter thick layer) at 50 ft. and
	25 ft.	above 50 ft it is flaggy again with much comminuted
	(75)	plant frags and carb.
		bird track sand as well as scours at base of massive unit at 50 ft.
11	60 ft.	poorly exposed shaley dk brownish
	(60)	gray w/ thin lenses of flaggy grownish ss
12	150 ft.	rusty weathering very dark gray siltstone
	(150)	carbonaceous flaggy
		becoming vfg ss at 150 ft. rippled. parallel lamination

unit no.	thick	description
12 (cont'd)	50 ft	silty at 160
	150 ft.	unit as a whole alternates with lenses of fine sand and silt (small)
	2020 ft to this point	
	250 ft	becoming sandier not to clean vfg ss rippled load cast forms shoulder here.
	100 ft	here there are some massive 1m thick ss rippled + parallel at least 6 of them defining a 10m band carb material on bedding plane, ch. forms
	50 ft.	H. gray vfg arenite

unit no	thick	dec
12 (cont'd)	100 ft.	
		interference ripples on slab here.
	this applies to Unit no 14 →	paleocurrent from drag marks and load casts and ripples is towards the NW (upstream
	50 ft	shoulder forming ss rich unit, interference ripples, load casts. vfg ss sands 30 cm thick
13	50 ft.	slightly covered gray shale unit
	10 ft.	
		becoming a flaggy silt in first 25 ft
		Pollen sample 8540 d

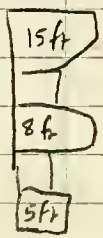
Unit no	thick	desc
14	26 ft.	lt yellow brown med sand, flaggy fo- basal 15, mass fo- top 11 beautiful drag mark + ripple paleocurrent NW clear outcrop forms cliff at creek.
15	35 ft	for 17 ft dk gray shale becoming ark interbedded vfs interbedded ss and shale in thin 1-2 cm seq- forms gullies
16	50 ft.	parallel bed ss in 10-40 cm thick yellow brown irreg weathered shoulder rippled

unit	no.	thick	descrip
17		150 ft	semi covered swale of dk gray shale covered by rubble
18		60 ft	load casts ripple beds flat lam carb on bedding plan vfg dirty ss parallel bounded units 20-30cm interbedded w/carb bearing units w/ 1 meter thick massive spine forming ss yellow brown interlaminate ripple at top
19		100 ft	flaggy med gray silt to vfg ss weathers to yellow brown becomes massive with a 1/2 m thick silt bed
			dark shale at 60 ft.-90 ft

unit no	thick	descr.
19 (cont'd)	50	top 20 ft becomes a cliff forming SS w/ ripples epsilon ~~SS~~ unit sand beds up to 50 cm Channel unit Stick and carbon fragments on bedding plane
20	78 ft.	starts w/ a coal (1.5m) CA to a mudstone siltstone parallel lam. interbeds tan to brown weathering beds thicken up increasing silt and SS up
		topped by rippled SS ledge former (3m)

Pollen sample 8540 e above coal

Unit no.	thick	description
21	~~extremely~~	extremely covered unit probably shale
	150 ft	at 100 ft. Unit is visible and has coarseness to flaggy interbeds of rippled ss and siltstone
	47 ft	the top 97 ft of this unit contains 3 flaggy ss beds rippled



Unit 21 as a whole
C↑

22	6 meters	pollen sample 8540f
	90 feet	very dk gray carb shale
	50 feet	parallel lam
		some rusty beds and thin carb bands

Unit no	thick	des
22 cont.		some brown in flag stones appear above 50 feet
	100 ft	top of sequence is a flaggy ss which forms a low shoulder on the hill. 100 ft thick
23	50 ft.	dk gray shale
24.	50 ft 15 ft	ss flagstone
25	35 ft 50 ft 35 ft.	dk gray shale pollen sample 85 ft g
26	26 ft.	ss flagstone low shoulder brown weathering
27.	55 ft.	black shale w/ numerous flaggy interbeds of silt.

swale

28	58 ft. 21 ft.	flaggy to massive sand with a 2 m shale split lower sand is trough x-bedded and forms a prominent nose, upper sand is massive and parallel laminated
29	10 m 50 ft 50 ft	very dark gray shale Pollen sample 8540 h unit well exposed in cut bank otherwise it forms a rubbly swale
		Chipping
		silty interbeds toward top
	50ft.	+ 10 m 95 ft } base of first rippled big siltstone interbed 25ft thick

400

	18 ft	two more yellow brown siltstone interbeds one at 150ft + 10m and one at 160ft + 10m the first is 50 cm thick the second is 2m thick. becomes a 2m coal at the top
30	50 ft	MASSIVE CLIFF forming sand (on west side of creek) fe-stained nodules load casts into underlying coal tabular cross beds yellow tan weathering organic trash on bedding plane lots of woody plant fragments in upper 3m grain size fine at base cm to med at top

31	50 ft	dk gray shale
32	93 ft.	flaggy ss unit paleo currents from dragmarks to the NW (upstream) on lower ss very low angle crossbeds sulfide nodules fossil angiosperm in fe-nodule (prob P. Reynoldsii) unit forms two low but prominent ridges and a distinct 2ft. high water fall fine grained the two units are separated by a a dark gray shale split Pollen Sample 8540 1

33	50 ft.	dk gray chippy shale interbedded with rippled pinkish flat lam sandstone w organic rich layers.
	50 ft	
	50 ft	
	150 ft.	1st shale 78 ft th 1st ss 15 ft thick
		ss in creasing in instance upwards.
	50 ft.	becomes very sandy with 3-4 ridge formers on the east side of the creek
	50 ft	1-3m thick each rippled separated by 12-15 feet of shale dirty f-m gr. ss w/ carbon streak on bedding plane
34	(over)	

34	50 ft.	organic rich unit
		dk gray shale at 10 ft
	50 ft	base CA to
		mudstone Pollen
	50 ft	20-40 ft 8540 J

40-50 ft is a rippled pinkish tabular sand

1/2 m coal at 60 ft.

60 - 150. interbedded mudstones and shales w/ lenticular downcutting
3 m yellow brown channel sand at 65 ft

2 - 40 cm ss near the top of the section.

35	6 ft.	Massive yellow channel very lenticular thickens from 2 to 5 meters clay pebble clusts at the base trough x-beds med SS
36	44 ft. 5 ft.	interbedded thin coal shale and minor SS. weathers to Swale lenticular Upper coal maybe up to ~~2m~~ 4 m
37	35 ft.	Massive yellow cliff former low angle x-beds carbon trash, rippled
38	65 ft. 22 ft.	shale split

39	25 ft.	Massive yellow-brown cliff forming SS undulating beds cliff on east side of creek
40.	50 ft 50 ft 50 ft. 80 ft	dk gray-brownish shale forms brownish smooth slope on east side of creek.
41.	172 ft.	Unit of lenticular channel sands - epsilon units, parallel lam, ripples carbon trash ; coals up to 2 m ; and laminated mudstones; and thin splay-like sandstones basal SS is 3-5 m thick

42	50 ft	Unit as below (41)
	50 ft	basal sand is above 50 ft. then interbeds of coal and shale and small ss
		one coal near top is 1m thick

Change from tape to Jacob staff.

true dip is 82°

12 meters

43	28 m	~~coal~~ dark grey shale, covered in swale dip 80 – 64 average 72°
44	26 m	Shale becomes exposed in cut bank, interbeds with coal - mudstone ↑ Pollen sample 8540 L
	1979	Mega fossil locality Aviculopecten rooted

dip 65° S

44 cont'd — increased sand to top

45 — 28 m — grungy SS unit slumpy and covered generally reddish stained SS 2-3 m thick with undetermined interbeds

46 — grungy SS irreg bedding carb rich mudstone

Porcelanite — 16 m
Sandstone

becoming well-exposed in west side of creek interbedded carb ½ m dark shales, and thin sand stone (rare)

dip to 40° S at 24 m

1 m sand at 30 m

46 cont'd

lenticular ss at 46m
3m thick

Dip 35°s at 64m

65m is a lenticular
Sandstone 3m thick
convolute beds
trough x-beds

76m

Pollen sample at ~~35~~ 40m
~~72m~~

ero at base of ss

47 10m

lenticular yellow-brown
med sand channel
varies from 4-10m

carbon trash at base

48. 12m

partially covered
swale containing
dk gray shale/lignite

dip 25° S

49 1.5 m alternating dk gray
1.5 m shale, mudstone,
1.5 m thin lignites and
1.5 m some minor 1-2 m
1.5 m lt yellow-brown to
pinkish sandstone.
coarse zone in middle

sandy base goes to 6m

1.5 m
1.5 m

dip 12° S

1.5 m
1.5 m
1.5 m
1.5 m
1.5 m
1.5 m top
1.5 m
1.0 m

Pollen Sample 8540N

Covered by rocky delta slope

The End

July 30, 1985

Fossil leaf in SS. float in strand line of Strand Fiord 8541

New Form.

many lvs in float from the delta of the small stream to the east onward to west.

Section 8542 in West Creek Strand Fiord. Section starts at the fork in west creek. Basal unit is a thick, vertically dipping sandstone.

Unit no	thick	des
1	57 ft.	pinkish to yellow brown weathering fg ss w/ climbing ripples ripples, parallel lam dip 85°-90° S prominent. Forms cliff at the fork of west creek carbon on the bedding plane
2	50 ft.	Swale partially covered
	50 ft.	dk gray shale sequence of
	50 ft	lignite up to (1/2 m)?
	50 ft	and flaggy sands
	50 ft	and mudstones
	30 ft	

Unit	thick	descrip
2 (cont'd)		(3 m coal at top)
		(below coal) sand at this level contains a nice uncollected mega fossil record in rotted platy fine sand
	32 ft	Cercidiphyllum "Betula" or "Alnus" photo
	true dip 70°	
3	3 m	Massive yellow-brown ss rippled fg climbing ripples Cliff former dip
4	60 m	Sequence of thin flaggy ss thin punky mudstone coals thin. slumpy shales pollen sample 8542a at 24 m

Unit no	thick	descrip
4 Cont'd		3 m thick ss at 4/2 m
5		sand, usual yellow-tan (2.5 m thick) ripple parallel bedded
		It begins a sequence of similar sands, split of dk gray shale + some lignite and punky mudstones.
		similar to previous unit
		the platy siltstones have roots up to 3 cm thick growing through them and they are rooted
		thin coals up to 50 cm
		one such coal @ 36 m

unit no	thick	des
	91.3m	unit is largely covered from 42 m to 91.3 m forms a delta-like projection into the stream Coal ~2m at 86m
6	1.5 m	thinly bedded 10-20 cm fg ss rippled w/ lots carbon trash med gray weathers lt gray to tan mottled interbedded with thin mudstones well exposed in cut bank platy looking outcrop Pollen 85426 at 6m vitrainite series sample Pl. Raynoldsi 85426 at 6m
	29 m	becoming coaly to top with a 1m coal in top 5m.

unit no.	thick	ides
7	27 m	Coaly sequence of dk gray carb shale with 3 - 50cm to 2 m well-exposed bituminous coals near base Unit as a whole is poorly exposed
8	5 m	typical ss channeled with long 8 ft log at base rippled carbon trash etc
9	33 m	swaley covered unit interbedded ss (small) shale, mudstone and minor coal. poorly exposed except at the top of the sequence

Unit no.	Thick	de.
10	26.2 m.	big coal well exposed in cut-bank of stream
		some small sand and mud and fe-stone mineralized
		becomes shaley w/ 8m with sandy stringers 10-30 cm thick
		Potter 8542d at 12 m
11	5.8 m	typical SS forms a shoulder
12	18m	lignite with thin sands in upper part
13	23.3 m	ripples, worm tubes sloggy ridge forming SS lt. gray
		V. fine maybe limey roots, wood

Good megafloria, possible Maple leaf. 8542e

Unit no	thick	des
14	21 m	smole dk gray clay becomes a coal at 15 m
15	16 m	sequence of sandstone with a big shale split Ss at base is 4 m thi Ss is yellow brown rippled wood frags flat lam.
16	16.8 m	covered at base prob mudstone F↑ to coal at 9.2 m coal is papery and not as good as previous bitu-coal

17

60m

interbedded pinking SS with rooting strata

Shale w/ mudstone

SS .25-1.50m thick

rooting and disturbance of ⊥ structure

load casts

climbing ripples

some thin fer stone and shales

wood and plant frags

pollen sample 8542f at 3m

lots of big roots

Shale up to 3m thick

Stop for lunch

dip changes to 65°S

100 m

pollen sample at 60+38m in mudstone 8542g

17 cont'd

45m

Pollen sample at
100m + 60m
8542 h

much interbedded
mudstone and shale
throughout unit

18

sandier version
of unit 17

interbedded
- .5 - 3m sandstones
- grungy shales
- minor coal

exposed as ridges on
west side of creek

switch to 50°s dip
at 36m

lt gray weathering

sand 65%.

Geology Agy.
Forestry Auth
Evidence from
N. Gunlund.
Phr Pleit
Trans.
Forest Trends.

(412) 622-3246

H.

40:
2
800

W 202 35th

RC49

exposed on side

big roots
Sandstones contain
plant rich feldspar nodules
stems
X-bedded trough
med grained
very light grey

Metasequoia cones
epsilon ratio.

Conifer
fossil nut 8542i

pollen sample at 60m
8542i

100m

coal at 90m

dip 55°

pollen sample at 106.5m
8542j

89 m dip still 55° S at
100 + 34 m

19 40 m Pollen 8542 K
at 2 m

Carbonaceous unit
starts with 3 m
dk gray shale + mudstone

then a 1-3 m lenticular
rooted rippled splay channel
sand.

then a swaley carb
shale with c shale interbeds
some fe-stone
no or very little sand

20	33½m	vfg to fg sandstone .5-1 m beds abundant fe-stains carb shale shales Crevasse splay sequen minor lignites up to 1 m Pollen sample 85421 at 25m
21		Coal unit w/ very lenticular, platy shales, sand lenses up to 5m thick very lenticular ripple x-beds channels in coal

dip 58°

pure coal by
26 m

49 m

8542 m pollen sans

8542 n vitrinite reflectn

beds above coal are nice, thin bedded platy ss - crevasse splays. Becom lenticularly.

huge beautiful
bituminous coal
w/ wood impression
forms valley

22

interbedded platy sandstone
carb mudstone
and minor coal

Unit is mainly a
lt yellow-tan weathering
platy ss which
forms low rubbly shoulders

becoming well exposed
in cut bank at 62m

Pollen sample 8542 @ 68 m

68m

apparent dip is 25° S
true dip about 50° S

1.5 m
1.5 ↓
1.5
2.0

thin lignite up to 1m

1.5
1.5
1.5
1.5
1.5
1.5
1.5

23 1.5
1.0

Coal, pinched in cut bank

24 2 X 1.5
1 m.

platy mudstone
CP to platy SS
yellow brown

25	1.5	coal which becomes
	1.5	stream base at
	1.5	mouth of west
	1.5	creek, prominent
	1.5	slope former
	1.5	overlain by platy
	1.5	splay deposits

offset to west creek mouth

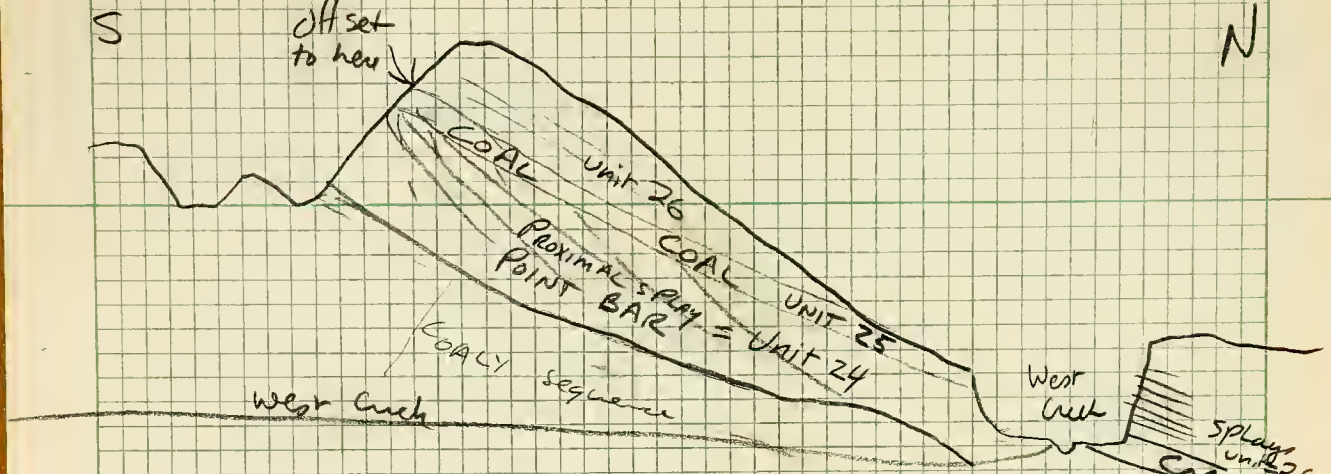
26 offset to mouth of west creek on hill (see picture)

	thick very prominent
	cliff of thinly bedded
5 x 1.5 m	SS splays, massive
1 m	towards middle
	(beds up to 2 m)
	thinner at base (0.10-20 m)

overlys thick coal in stream

sloping on hill, iron stain at surface.

West Creek Mouth Diagram
PX-79



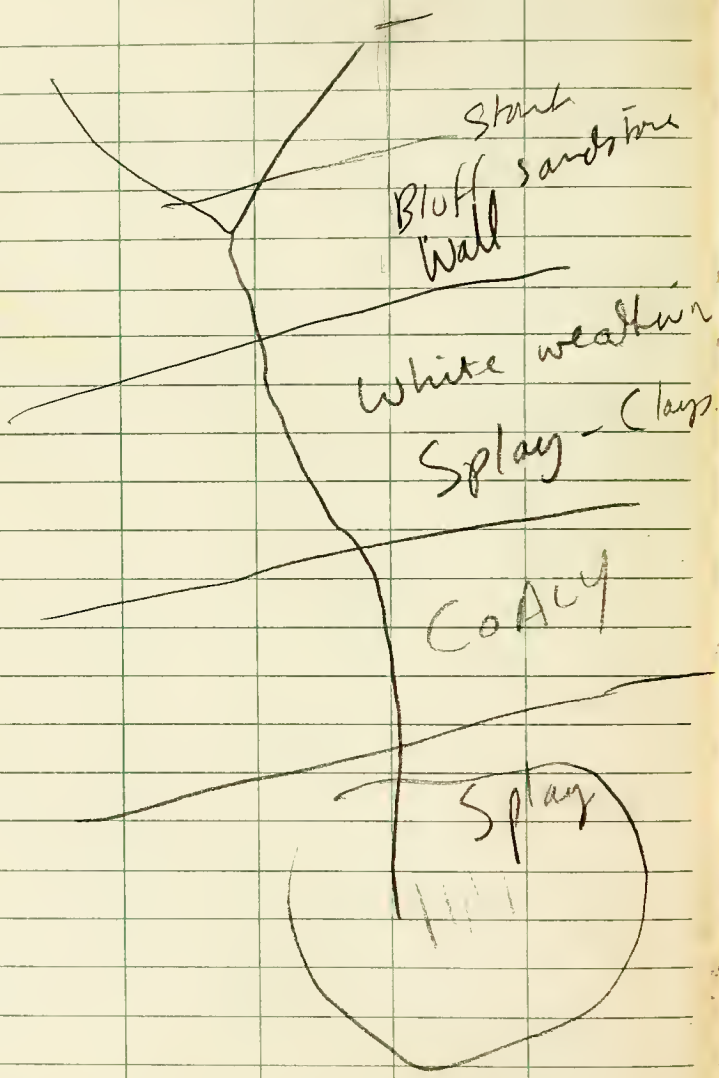
		dip 4° N
27	36 x 1.5 m	interbedded coals shales and platy sands. poorly exposed on slopes
		at 2 x 1.5 m dip changes to 10° N
		1.0-2 1-2 m coal interbeds
		Aker at (6x1.5) - 1 m
28	2 m	flaggy ss forms
	2 m	shoulder
	2 m	Cercidiphyllum
	2 m	
	2 m	dip 30° N
29	(1.5) x 17.1 m	interbedded unit as in
	1.4 m	# 27
		apparent dip is 5° S
		split in 2 m coal
		pollen at 17 x 1.5 m
		8542 p

30	3 (1.5) m	SS platy
31	7 (1.5) m	semi-covered shaley Units
32	1.5 34 m ~~4.5~~ 4 × 1.5 m	Slaty ss interbedded with carb shale and mudstone some coal ½-1 m ss is rippled occasional fe-stone Coal at top is highest bed in the sequence

Top of F.S. in Strand

(1)90

1170


Stark
Bluff Wall
sandstone
White weathin
Splay - Clays.
COALY
Splay

Today began at 9

hiked until 11:30

measured until 5:00

hiked until

Yesterday began at 11

hiked until 3

measured until 11

8543 fossil Ammonite in nodule

in delta of east creek

8544 July 31, 1955

Soil Sample at Camp site
at Strand Fiord.

moved by Twin Otter
(pilot Dunk)
Arr. at 6:00 pm

Arr. at Swinnerton Peninsula
at 8:30

Loc 8455 AUGUST 1, 1985

Sunny, ϕ, very windy
09 at 20-25 km.
Temp +9°C

Ledges of CLAY FE STONE above
Coals in slope marked 8455
Lvs & pl remains
Cercid
Metasequoia
Equisetum
Acer
Platanus
Few pinnate.

8545a Lower Beds
Cercidiphyllum
Metasequoia
Platanus nobilis
Inlet #1

8545b Metasequoia
Platanus
Cornus
Osmunda grandifolia
Inlet #2

8545c Upper But below level of upper coal
Paleonphar?
Sequoia cone?

8545 c (cont'd)

Metasequoia

Cercidiphyllum leaves + fruit

Vinea?

Cocculus flabella

Acer

Osmunda greenlandica

Platanus nobilis

8545 e Vertebrate site above upper coal

Mary + Cliff found large tapir tooth

Hyrachius

crocodilian teeth.

8546

Aug 1, 1985
Very windy, Clear
+5°C wind
15-20 KN?

Mbr IV E.S. Fm
Acer leaf. Acer beringiana?
(Maze)

~~Mo~~ Swinnerton Peninsula.

Above 2nd thick coal (higher of two)
in hill n. of camp

Bluff capped by 30-40' of
boulder conglom. whose
principal constituent is
red granite.

Cliff + Mary found part of a
crocodile skull, two types of
turtle and a Hyrachyus foot
bone. This was relatively poor
material being waterworn &
fragmentary.

Loc. 8547 August 2, 1985

AT 4 levels
in E.S. Mbr IV in
Swinnerton Peninsula.
S. Side at western
edge of outcrop

from base to top:
8547 a Osmunda Level
8547 b Johnson Sand level
8547 c Skgelreuteria ~~Salvinia~~ level
8547 d Ginkgo level
8547 e Highest level
Acer.

8547 e Platanus nobilis
Acer beringiana ~~the~~
Huge lvs.
Averrhoites affinis
~~Ze~~ Zelkova ! new for
flora
Cercidiphyllum
Mysterious fruits

New palmate Compound Rosaceous (?) leaf

8547d Ginkgo level
Huge Ginkgo lvs.
Plat. wahlis
Smashed cercidiphyllum (huge)
Viburnum ?
Cercidiphyllum pods

8547e Koleroteria level
Kol. seeds
Platanus nuh
Viburnum ?
Cercidiphyllum
Plat. raynoldsii

NOTE: This level actually lies about 20' above 8547d.

NOTE well! All wrapped specimens w/ 8547e+ have to be renumbered from 45 to 47. Do not unwrap w/others

AUG 3 1985

Swinnerton Peninsula

Stratigraphic section 8548 starts in river valley at base of Petro Canada Coal #7, a coal which is really only well exposed for about 100 m on the banks of a mud filled stream directly below the vertebrate locality #8

8548

Unit	thickness	description
		in streambed and base covered by tundra
1	1.5m	tan-gray weathering sands
	1.5m	with ledges of Fe-stone
	1.5m	F-M grained, sub-rounded
	1.5m	apparently with lignitized
	1.5m	wood.
	1.5	Eureka Sound Fm. Member IV
	↕ 3% / 4%	apparent dip
	.5m	Fe-stone layers at 5.5 m, some plants at 10 m

		Σ Thickn	
1 cont'd	Σ = 9.5 m		Cercidiphyllum at top
2	1.5m		Thick Coal, Petro Com #7
	1.5m		dip 1/2° N
	1.5m		Forming prominent bluff in small
	1.5m		stream drainage.
	1.5m		Flakey wood coal as at Stevens
	1.0m		Fiord Coal Creek Section
	Σ = 9	18.5	Contains numerous carbonized and petri. some sort of petrified wood
3	1.5m		Pollen Sample 8548a
	1.1m		.2m above base
			Pollen Sample 8548b
	Σ = 2.6	21.1	1.5m above base
			INTBD dk gray carb clays and mudstones (limonite yellow) some lignite. Clays have carbonized branch and wood fragments.
4	OVB		

		Σ Thick.	
4	1.5 m		tan weathering vfg sand
	1.5 m		with thin iron stone ledges, iron stained
	1.5 m		lenses of dk gray clay.
	1.5 m		Sand is very clayey
	1.2 m		poorly washed
	$\boxed{\Sigma = 7.2\text{m}}$	28.3 m	Fe-nodules w/ Metasequoia
5	1.5 m		lt. gray med gr.
	1.5 m		unconsd. SS with Beds
	1.5 m		of slabby ironstone
	1.5 m		concr
			poorly washed
	1.5 m		some orange staining
	1.5 m		
			Fe stone ledge @ 6.4-6.8m
	1.5 m		forms rubbly ledge
	1.5 m		above 9 m the unit has
			bands of med gray clay
			and many Fe-stone layers
			locality 8545 a
			12.6-12.8 m
	1.5 m		Oscid. / Platanus

		Σ Thick	
5 cont'd	1.5		
	1.5		Clays increasing in # towards top of unit
	1.5		
	1.5		
	1.5		
	1.5		
	1.5		locality 8545b at 24.4 - 24.5 m Metasequoia Cercidiphyllum Osmunda Glyptostrobus P. nobilis
	1.5 m		
	1.5 m		Pollen sample 8548c 5.7m from top of unit
	1.5 m		
	1.5 m		
	1.5 m		total for unit = 34.2 m
	1.5 m		
Σ = 34.2	1.2 m	62.05	
6	1 m	63.5	small coal layer weathering to very dk gray - blackish popcorn texture on slope Shaft at 470

	Cumul. Σ Thickness	
7	1.5m	ditto unit 4
	1.5m	lt. gray sand with fe-staining
		ironstone concs and
		clay layers
		increase dip to 10%
	1.5	
	1.5	at 6m a 10 cm clay
		ironstone ledge w
	1.0	Cercidiphyllum
	Σ = 7.1m 70.5	
8		yellow brown weathering
	3(1.5) m	crossbedded med grained
	.5 m	sand, friable, clayey
		x-bedded w lignitized
	1.5m	wood, lenticular.
		forms a shoulder on
		slope,
		Some lithified chunks w/x-beds
	Σ = 6.5 77	
		low angle tabular
		orange stains
		Fe-nodules
		some carb on laminae

		Thick Cum	
9	1.2m	78.2	Plant locality 8545c which includes 3 sublocalities at the same stratigraphic level
			Thin swale forming gray sand F A to siltstone and clay with clay ironstone at top
			Good locality! 8545c
			dip increase to 15% wd
10			Pollen sample 8548d at 3.2m
	6 (1.5m)		Coal
	.5m		with some shaley interbeds at base
	Σ = 9.5m	87.7	coal is platy and papery like lower large coal and Stenkwd Coal.
			Also carbonized wood fragment.

			dip 42% W
		Cum. Th.	
11	2 m		fossil Cercidiphyllum fruit
	2 m		leaves + foliage
	2 m		Metasequoia Cone
	2 m		sample number 8548e
	2 m		
	2 m		vfg ss w thin beds of
	2 m		orange Fe-stain. Planar
	2 m		laminations with some carbon
	2 m		on bedding plane
	2 m		
	2 m		
	2 m		Planar laminations are well-
			exposed on a distinctive
	$\Sigma = 22.2$ m	109.9	bifurcated sand at 12-15 m.
			This sand forms large blocks
			which slump down the
			slope and plate apart.
12	2.2 m	112.1	Coal
			w/ Fe-stain at top

Unit no.

13

17m

to dip slope
of rubbly fe-stone

organic traces in some layers

Some layers have a large clay component

Slope is distinctly rubble covered w/ much fe stone

Fauna: Tapir
Hyrachius
2 turtles
Allognathosuchus

Vertebrates seem to occur near the top of the unit beneath the mantling layer of fe-stone nodules.

Mary

Vertebrate sand - Locality 8

129.1

Poorly sorted coarse to med beds alternating w/ f-m beds of SS

pebbles of lt gray weathered granite up to 10 cm - 40 cm

grit layers

rolled ~~sar~~ sand armored fe-stone nodules

numerous fe stone nodules

large clay ball clasts up to 1/2 m, red gray

sand has a distinct banded look where it is well-exposed. Bands are limonite brown, yellow-gray, and med-dark gray.

Pollen sample from Clay ball clast at 6.5m
8548F

bands .5 - 3 m thick

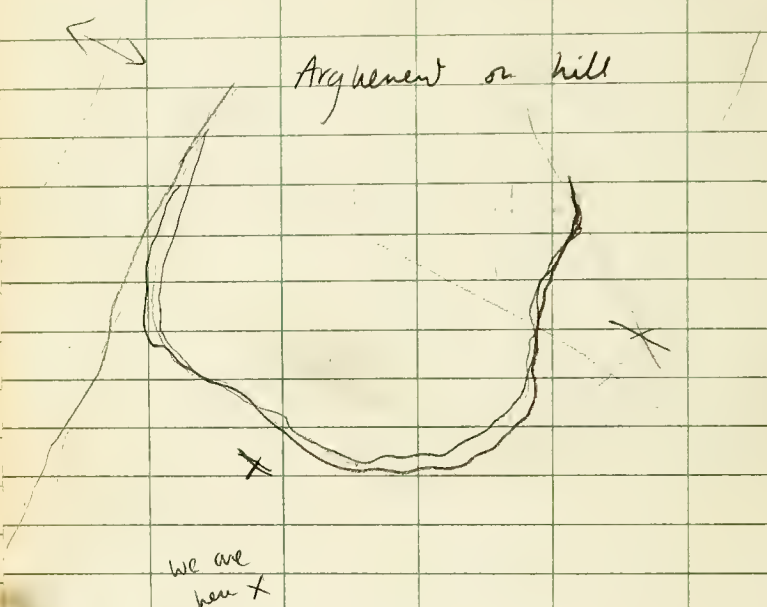
Fe stone at 12 m

Section 8548 offset

Section now offsets to west through a valley of two coals. This valley has two coals running almost parallel to slope on the west side of the valley. It appears although the lower of the two coals overlies the vertebrate sand. Offset starts at the base of the first coal.

Unit no.	thickness	Cum. Thick	description
14	1.4 m	130.5	1st coal of coal pair
15	1.4 m	131.9	sandy split in coals which ~~are~~ thickens to the west to a large cross-bedded channel 10 m thick Fe-stone w/ Acer Cercid Metasequoia

16	1.8 m	133.7 2nd coal of coal pair
17	6 (1.5) m 1.25 m $\boxed{\Sigma = 10.25\,m}$	very light gray ss "White Sandy" w/ numerous ironstone forms a whitish low shoulder across valley to west. 143.95 Here is a fe-stone covered surface
	Much P. notalis sample 8548 g near base	at 5m there is a .25m almost entirely covered coal unit this coal better exposed in the valley to the west
18	1 m	144.95 Coal which forms the prominent bowl of the syncline w/ wood capped by Fe-stone
	dip now 0°	semi-covered
19	10 (1.5 m) .5 m Σ 15.5 m	yellow-brown sandy matrix, rubbly + fe stone 160.45 w/ lithified lenses of dk brown gritty sand w/ clay gall + ironstone clasts at 12 m
top at axis of syncline		



Platanus mobilis at 8548g in
White Sandy Unit is

19cm long 23cm wide

Near 8548g, a trough-cross bedded sand
in a gully well exposed

Stratigraphic section Section 8549

On west side of Swinnerton Peninsula & in isolated outcrops of Eureka Sound Formation.

Base of section in slumped covered alluvial valley of Swinnerton Weir Creek

Unit no.	thickness	cum	description
1	4.7m	4.7	dip 4% W Carbonaceous clay interbedded with lt gray sand weathering to tan. Clay fission small ss as unit 2
Flora 8547a here			
			Contact gradational
2	4.9 m	9.6	med grained dirty sand interbedded with silt and clay ↑ weathers to a lt gray. Very dk. gray at base becoming lt. yellowish gray as it coarsens. Forms prominent white shoulder. (dentritic) Carb wood
3	1.8m	11.4	Coal.

		Cum. Thick	
4	2.5 m	13.9	Pollen sample 8549a at base dk gray chippy carb. mudstone ct to next unit has become a gunky clay at 1.5 m
5	4.0 m	17.9	friable tan sand forming a shoulder poorly bedded med grained weathers to tan well rounded carbon. layers Osmunda level 8547a at 2.8 m.
6	1.5		very dk gray carb clay alternating w/ dk brownish gray mudstone. lenses of clay Fe-stone weathers variegated dk gray red gray, yellow brown, tan

		Cum Thick	
	15.95	33.85	w/ minor interbedded lignite at 2m and 7.5m some sand interbeds Pollen sample 85496 at 9m Clay Ironstone at 9-10.5m dip to 30% at 12m
7	11 (1.5) m Σ = 33 m	66.85	Coarse pink/gray sand with sand armored clay balls Fe-stone concs Prob. rounded granite clasts from 2-3 inches up to 8-10 inches Flora 85476 Johnson Sand at 7.5m Friable sand forms a shoulder fossil wood

	Thickness	cum	
8	2.3m	69.15	coal
9	6.0m	75.15	interbedded fine clayey sand w/ brown sandy clay, occasional Fe stains rippled weathers to lt yellow-gray.
10	4.0m	79.15	lignitic clay and mudstone forms low shoulder below big lignite weathers yellow-dk gray Pollen sample V8549c at .5m
11	3.9m	83.05	Woody coal, most prominent coal on hill, top of coal is a wood, coal is very woody, forms black strea

		Cum Thick	
			starts on a 1" fe layer (soil?)
12			f-grained sub rounded
	9.4m	92.45	H yellow gray ss
			fe stain nodules
			C↑ to a coarse
			sub angular ss w
			granite clasts up to
			1 ft. (rare) w/ clay
			fe stain ledges.
			trough x-bedded in often
			rotation
			lignitized wood.
			cobbles start at 3.5m
			Ginkgo level 8547d
			at 4m
			dip now 46° W
13			interbedded lt gray clays
			and and trough-crossbedded
			lt gray med grained
			ss
			Koelreuteria level 8547dC
			at 8m

13 cont'd

lense of coarse cobbly layer at 7.5m

32.2m 124.65 w/armored fe stone grit, clay galls, granite clasts - ends at 14m

unit F↑ to top, lenses [28.25m lignite] and a fe stone cap

top of lignite at 31m

14

true dip 75° W

shot at apparent dip of 37.5° W

lt gray coarse poorly sorted, (pinkish), carbon blebs and on bedding planes

lignified wood

parallel bed + lam.

Fe-stained

faulted and jumbled in places

	Cum Thick	
		lithified layer of thinly plated w/clay galls and 1m x 20cm
		coaly lense at 24m
		clay clasts.
57.5m	182.15	Fe-stone lags
		clay ball clasts at 40m
		dip changed to 45° @ 32 m
		granite boulders on slopes
		microfaulting of silty layer
		~~dip to~~
		last 1.5 m FT to thin lignite and shales.
		Pollen sample 8549 at 56 m

The whole unit is very lenticular and thins to N.S.

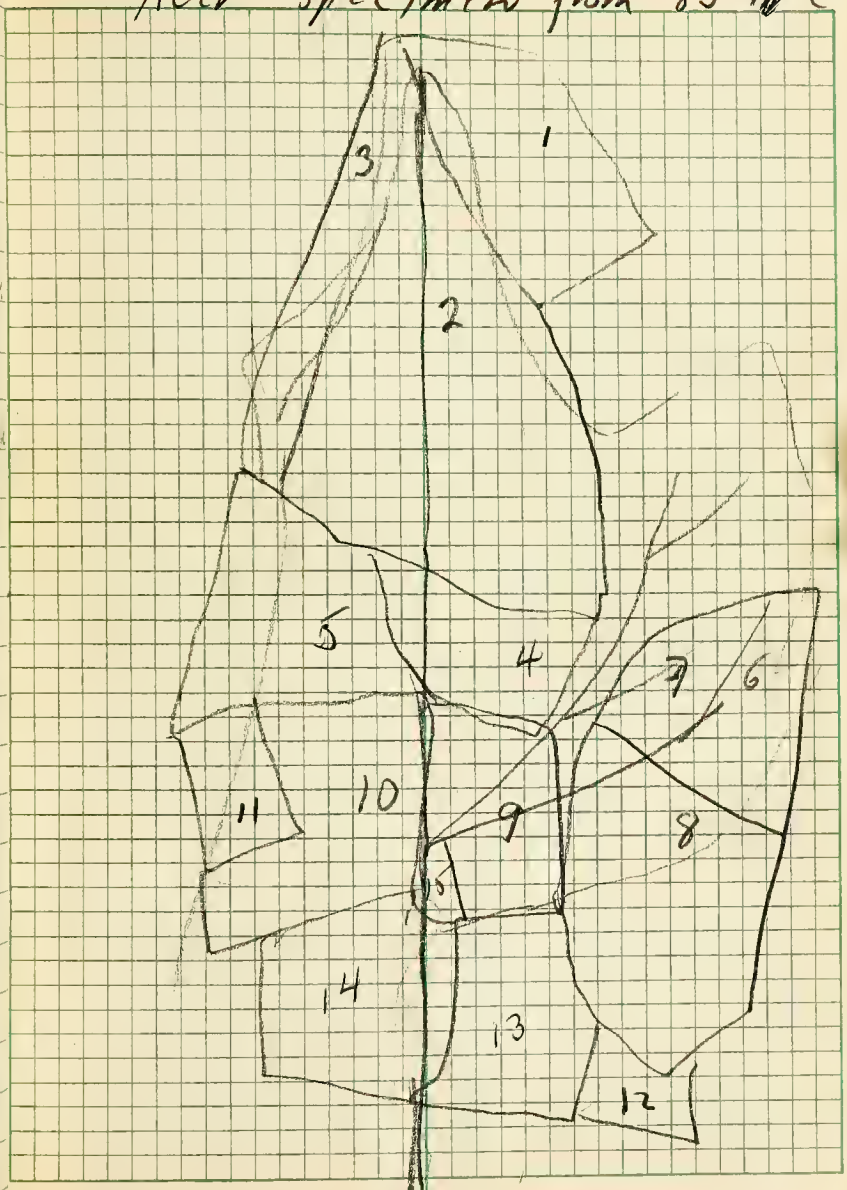
		Cum Thick	
15	2.4m	184.05	Coal w/tree stem
16			thin bedded rippled to flat lam
			fine clayey sand from 0-4
			30cm grit channel at 2m
			at 4m unit coarsens to a coarse trough crossbedded unit w/ yellow and pinkish stains
			thin coarse lense at 9 - 11.8m
			carbon of bedding plane
			granite clasts up to 10cm
			11.8 color goes from lt gray, scouring into the lower unit

		Cum Thick	
			C-m grain fraction
30.5m		215.05	carbon layers
			at 20.5m to 21.5 a clay-ironstone lense with a fossil flora 8547c
			Pollen sample 8549c
			at 27 lithologe becomes ripples to parallel fine grain ss to siltstone same as basal 4m of unit
17	8.6m	223.65	begins as brownish-gray med-grain sub angular shoulder forming ss, lenticular
			CA up at 3m to coarse beds of grit and claystone
			rolled armored clay-fe clast channel.

18	10 m	interbedded sequence of thin coals shales and ss ends in border fault mass. Beds here are essentially vertical
19	6.52	at 10 m friable brownish sand, mostly covered
20	10 cm	coal disturbed by faulting, appears to be as large as 2 m

End of Section

Acer specimen from 854 e



Plane Hours

Date	Otter	Cum	Helicop	Cum.
7/7/85	2.4	2.4		
7/10/85	2.1	4.5	4.6	4.6
7/12/85	3.0	7.5		
7/17/85	1.0	8.5	2.6	7.2
7/18/85			2.6	9.8
7/19/85			5.5	16.3
7/21/85	4.0	12.5		
7/23/85	0.5	13.0		
7/25/85	3.0	16.0	4.25	20.55
7/28/85			1.00	21.55
7/29/85	3.0	19.0		
7/31/85	6.0	25.0		
8/1/85			4.00	25.55

Stay	Cond	Vis	Weath	Wind	Clouds
E50 ~~E15~~		10+ to W in H. 1½ mi to S	F 8 ↳ rep of F. at 350'	26 at 01	SC 6 AS 2
			Rem	Sun Vis	
E50 ~~E15~~		15+ in Hills Low Fog Bks to S & W Hill	F 2	26 at 07	SC 6 AC 2

Bay Fwd Sched.
- How ~~are~~ in work going
- Progress of section
- Reconnaissance What done? - Hrs. mal
- Exc. date ~~[illegible]~~
- H. Chapter (no more time except for exam)

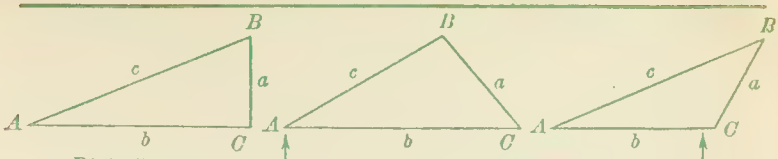
Stuff to send to Petersburg
Pubrao

All but one sleeping bag
Green one stamp in PESP
Blue bag all to Petersburg
Dark packs
Left over food to kitchen

Tents to PTS
Green + Red

Stay Bay Tent
+ Tan North Fork

TRIGONOMETRIC FORMULÆ



Right Triangle — Oblique Triangles

Solution of Right Triangles

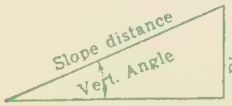
For Angle A. $\sin = \frac{a}{c}$, $\cos = \frac{b}{c}$, $\tan = \frac{a}{b}$, $\cot = \frac{b}{a}$, $\sec = \frac{c}{b}$, $\operatorname{cosec} = \frac{c}{a}$

Given	Required	
a, b	A, B, c	$\tan A = \frac{a}{b} = \cot B,\ c = \sqrt{a^2 + b^2} = a\sqrt{1 + \frac{b^2}{a^2}}$
a, c	A, B, b	$\sin A = \frac{a}{c} = \cos B,\ b = \sqrt{(c+a)(c-a)} = c\sqrt{1 - \frac{a^2}{c^2}}$
A, a	B, b, c	$B = 90° - A,\ b = a \cot A,\ c = \frac{a}{\sin A}.$
A, b	B, a, c	$B = 90° - A,\ a = b \tan A,\ c = \frac{b}{\cos A}.$
A, c	B, a, b	$B = 90° - A,\ a = c \sin A,\ b = c \cos A,$

Solution of Oblique Triangles

Given	Required	
A, B, a	b, c, C	$b = \frac{a \sin B}{\sin A},\ C = 180° - (A + B),\ c = \frac{a \sin C}{\sin A}$
A, a, b	B, c, C	$\sin B = \frac{b \sin A}{a},\ C = 180° - (A + B),\ c = \frac{a \sin C}{\sin A}$
a, b, C	A, B, c	$A + B = 180° - C,\ \tan \frac{1}{2}(A - B) = \frac{(a-b)\tan \frac{1}{2}(A+B)}{a + b},$ $c = \frac{a \sin C}{\sin A}$
a, b, c	A, B, C	$s = \frac{a+b+c}{2},\ \sin \frac{1}{2} A = \sqrt{\frac{(s-b)(s-c)}{b\,c}},$ $\sin \frac{1}{2} B = \sqrt{\frac{(s-a)(s-c)}{a\,c}},\ C = 180° - (A + B)$
a, b, c	Area	$s = \frac{a+b+c}{2},\ \text{area} = \sqrt{s(s-a)(s-b)(s-c)}$
A, b, c	Area	$\text{area} = \frac{b\,c \sin A}{2}$
A, B, C, a	Area	$\text{area} = \frac{a^2 \sin B \sin C}{2 \sin A}$

REDUCTION TO HORIZONTAL



Horizontal distance

Horizontal distance = Slope distance multiplied by the cosine of the vertical angle. Thus: slope distance = 319.4 ft. Vert. angle = 5° 10′. From Table, Page IX. cos 5° 10′ = .9959. Horizontal distance = 319.4 × .9959 = 318.09 ft.

Horizontal distance also = Slope distance minus slope distance times (1 − cosine of vertical angle). With the same figures as in the preceding example, the following result is obtained. Cosine 5° 10′ = .9959. 1 − .9959 = 0041. 319.4 × .0041 = 1.31. 319.4 − 1.31 = 318 09 ft.

When the rise is known, the horizontal distance is approximately:—the slope distance less the square of the rise divided by twice the slope distance. Thus: rise = 14 ft., slope distance = 302.6 ft. Horizontal distance $= 302.6 - \frac{14 \times 14}{2 \times 302.6} = 302.6 - 0.32 = 302.28$ ft.

MADE IN U. S. A.